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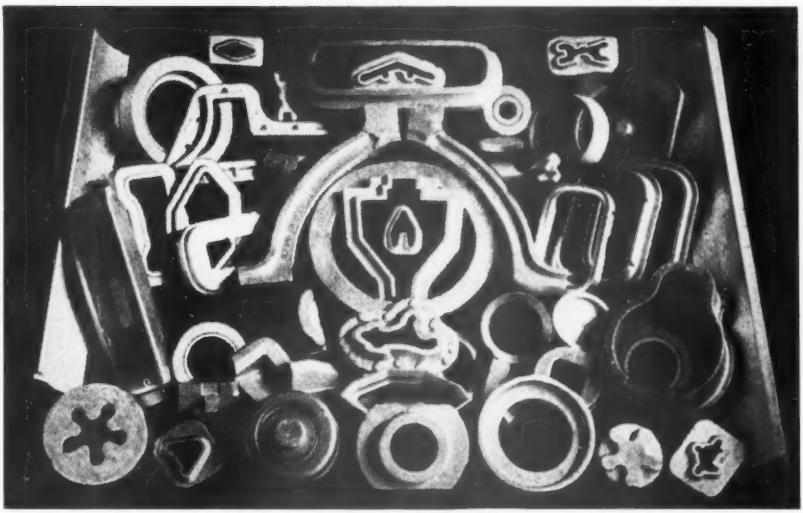

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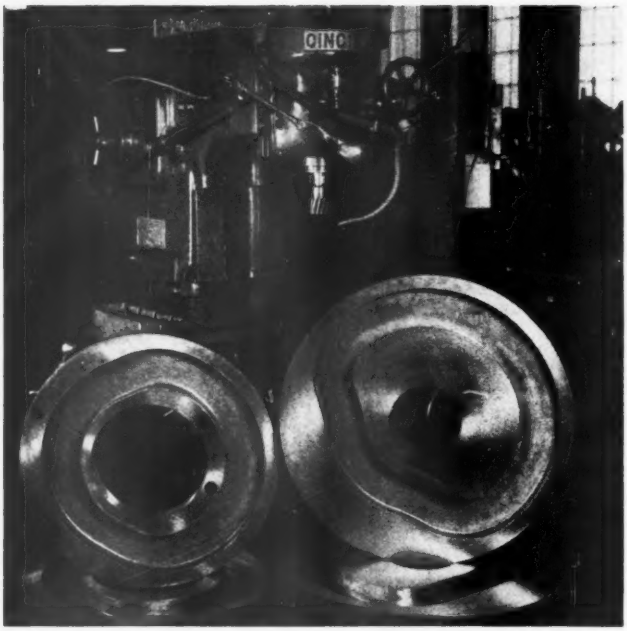

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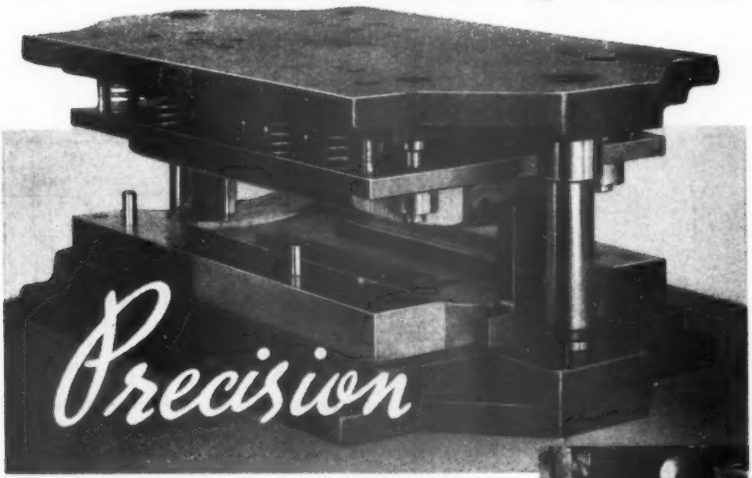

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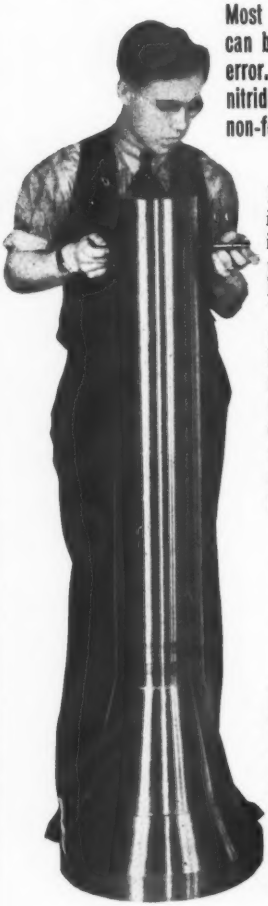

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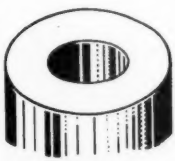
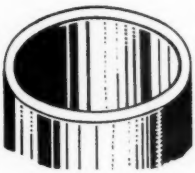


Carbonized and hardened tool steel - bore ½″, length 2″.



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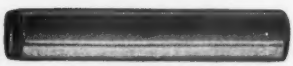

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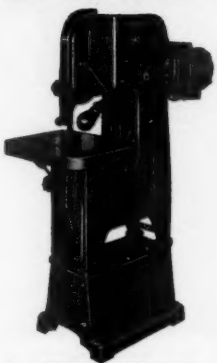

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Tool • Die • Machine **PROGRESS**

The National Tool and Die Journal

February, 1939 **Vol. 4, No. 11**

Progress of Die Casting Through Proper Design and Tool Equipment

By Charles G. Siefert

Cleveland Hardware & Forging Co.

ALTHOUGH the die casting of metals is thought to be a modern development, it is a matter of record that the first die casting machine patent was issued 90 years ago. This machine was actually used for printers' type in lead. The term itself—die casting—is applied to the process of making castings by forcing molten metal into a metal die by a pressure other than gravity.

Important developments have been made in die casting in recent years and the use of die castings in industry has been very greatly extended.

For some years the more important developments in the Die Casting Industry concerned themselves with the purity of the base metal and the mixtures of alloy metals. In these developments the metal compounds have done their full share. The range of metals which can be successfully die cast has been increased to include zinc, brass, aluminum and its alloys and magnesium metal.

Brass die casting, for example, has made great progress in the past five years. One of the largest producers of brass hardware stated recently that 67 per cent of a yearly production of 8,000,000 castings, all formerly sand-cast, are now die cast and that overall savings, including machining and overheads, actually amount, in many of the die castings, to as much as 50 per cent. Brass die castings were restricted previously by the short life of the dies, which rapidly depreciated on account of the high temperatures used. But developments of special semi-high speed steels for dies and of die alloys that can be successfully employed in the new high pressure die casting machines have greatly improved the results obtainable and it is now claimed that these steel dies will produce 30,000 to 50,000 pieces before it becomes necessary to replace them.

Large quantities of die castings are made of zinc base alloys. Some especially strong zinc base die castings of the Zamak type have recently been developed, which are not subject to the usual inter-crystalline grain growth or warpage in service. The physical properties of older zinc bases were poor, due to the presence of small quantities of lead or tin. Tensile strengths previously very low, can be very high in modern zinc alloys (up to 45,000 lbs. per square inch) and castings are free of defects formerly

impossible to eradicate.

At present, while the development of alloys still goes on, the more important recent developments of die casting have resolved themselves into those of providing dies of proper design for use on modern equipment. Into this picture has come a new specialist—the die casting engineer—a consultant whose experience and training enables him to improve ordinary design features, to avoid many difficulties which otherwise had to be overcome laboriously—and expensively.

Die castings today are definitely the joint work of the designing or die casting engineer and the die maker; the tool room has become an indispensable auxiliary in the die casting method of producing intricate shapes as well as holding to close tolerances.

The great increase in the use of die castings is an opportunity for the contract die builder whose facilities, in many cases, are readily adaptable for making die casting dies.

Complicated parts can now be die cast with comparative ease because of the complete mechanization of the die casting process. Dies that are fully automatic, as to the operation of numerous side core movements, as well as angular cored holes, can be operated by one man. Another advantage of the automatic dies is that their core movements can be timed so accurately that cores can be pulled within a main core. Automatic dies have also speeded up die casting and eliminated the uncertainty and hazards of the human element.

Emphasis on Design

Logically, the present emphasis on design has made the position of the die casting engineer more important than ever. Many product engineers have already established the procedure of calling in a die casting engineer before settling on all details because the latter can usually suggest changes that often will greatly reduce the die cost and at the same time result in better castings. Many times it is cheaper to drill a hole than core it; radii are often misplaced and in some cases this adds considerably to the die cost.

The accompanying illustrations are a case in point. Figure No. 1 shows a cross section of a proposed bracket for an auto fender as submitted to the die caster. If the die had been made directly without any modifications it would have been necessary to spend a good deal more time, specifically it would have cost from $50.00 to $60.00 more than the cost of a somewhat simplified, revised design that the die caster was able

(Continued on page 36)

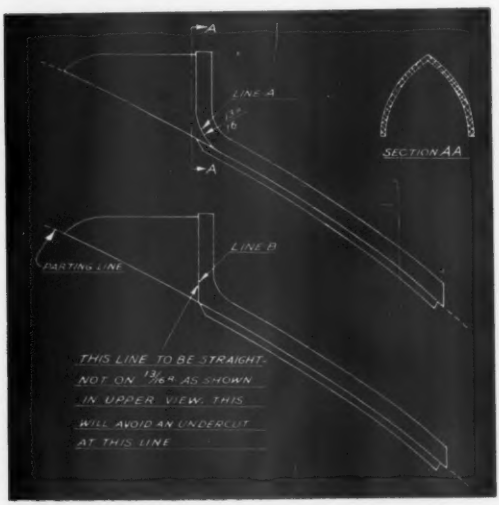


Fig. 1. (upper) Cross sections of proposed bracket for auto fender, drawing as submitted by manufacturer to the die caster. Note the irregular parting line "A," that would involve additional labor in fitting to template and routing.

Fig. 2. (lower) Cross section of fender bracket with the parting line "B" simplified, saving time and reducing cost of the die. It is this type of designing service that makes the die casting engineer valuable to his customers.

Die Designing and Estimating

Advanced Series

II

By GEORGE DANNES

George Dannes is superintendent and engineer of the Raffel Manufacturing Company of Chicago, and instructor in the advanced class studying Die Designing and Estimating at the Carl Schurz High School under the auspices of the Chicago District of the Special Tool, Die and Machine Shop Institute.

IT is generally agreed that it is not usually possible to accurately estimate the cost of a tool or die from charts and tables and if the use of charts and tables *alone* is meant then there can be no argument at all. Charts and tables avail comparatively little unless they are supplemented with a first class knowledge of the construction of tools and dies, their working principles and the machinery associated with their use. No formula ever developed can be of use unless its fundamentals are thoroughly understood.

Accurately estimating the cost of a production tool or die calls for experience in the making of it plus the ability to mentally visualize the machine and handwork necessary for construction. Such an estimator should be able to easily adapt for his use the tables which are to follow in these articles. They were developed to eliminate guesswork to as great an extent as possible and to provide short cuts for estimating the average run of tools and dies.

To explain this method of estimating it will be necessary to start at the beginning with a simple design; thus the tables will at once become more understandable to the estimator. We will select the cutting die because of the simplicity of its construction and also because it is probably the most widely used type of die.

Cutting dies are readily divided into six distinct types, namely:

1. Piercing dies
2. Blanking dies
3. Compound piercing and blanking dies
4. Progressive piercing and blanking dies
5. Cut-off dies
6. Piercing and cut-off dies

Next we select a simple part and design a suitable die for it, then estimate its cost. Fig. 1 illustrates such a piece part which is to be made in quantities of 500,000 pieces.

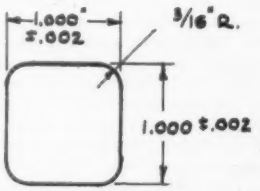


Fig. 1

The shape of this piece and the tolerances which are indicated suggest immediately the type of die which must be built for its production. It cannot be produced satisfactorily with any other than the blanking die because a tolerance

of .002" is required. Further careful study of the piece in Fig. 1 gives the estimator such additional information as the thickness of the die block required, the type of punch to be used, whether it will be necessary to mount the die on a leader pin die set or if the standard die shoe and punch holder will be sufficient; also whether there must be an automatic stop or merely a pin stop. The determination of these factors is very important. They constitute the foundation of estimating therefore they should be definitely pre-determined from the blueprint or the part itself.

The table which follows shows the relation of die block thicknesses required

Stock-Thickn.	QUANTITY 5M	25M	50M	100M	500M	Unlim.
.015	3/8	1/2	5/8	3/4	1"	1 1/8
.031	1/2	5/8	3/4	1	1 1/8	1 1/8
.093	5/8	3/4	1	1 1/8	1 1/4	1 3/8
.125	3/4	1	1 1/8	1 1/4	1 1/4	1 3/8
.187	1	1 1/8	1 1/8	1 1/4	1 3/8	1 1/2
.250	1 1/4	1 1/4	1 1/4	1 3/8	1 1/2	1 1/2

DIE BLOCK THICKNESS.

When the die is to be used for blanking parts made of lamination stock or other extremely hard or tough materials, increase the thicknesses given in the table by 1/8". For bakelite, brass or similar soft materials, reduce by 1/8".

Fig. 2

for various stock thicknesses and production quantities.

Now considering the part illustrated in Fig. 1 in relation to the table, Fig. 2, we find that a die block thickness of 1 1/8" will be required to assure a satisfactory production of 500,000 pieces from the die. With the die block thickness established, we now decide upon a punch with dimensions to correspond, then we are ready to sketch the die itself. For estimating purposes we will use only two types of punches and we will distinguish

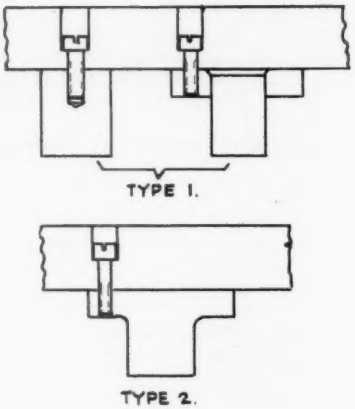


Fig. 3

between them as types 1 and 2 as illustrated in Fig. 3.

Type 1 represents any punch which can be machined easily on all sides and which, as shown in the illustration, can be mounted either to the punch holder directly or inserted into the punch pad. Type 2 represents all punches which have shoulders or mounting pads as integral parts of the punch itself and the machining of which may be more difficult. Both types of punches "hold through" regardless of size or shape. A length of 1¾" is assumed to be the standard for the time values given in the tables. Because of the simple shape of the part we are considering, it is possible to select the type 1 punch. A punch pad and also a stripper will of course be required.

Now we are ready for the sketch of the blanking die which would be required. Fig. 4 shows both the plan view and the cross section of our die.

Such a sketch MUST precede every estimate because it gives the estimator a better "feel" of the job, brings every part of the die clearly to his attention and shows better than in any other way the "danger spots" in the construction of the die. Furthermore, such a sketch be-

A NEW BOOK ON DIES

The first series of articles on Die Designing and Estimating by Charles Bohmer is being reprinted in book form. Pre-publication price $1.00 per copy postpaid (regular $1.50). Order from George J. Huebner, Publisher, 311 Fairmount-Cedar Bldg., Cleveland, Ohio.

comes a handy reference for the die designer, showing him the lines along which the die shoud be laid out for the tool room or the die shop.

It will be noted from the sketch that a leader pin die set was chosen. This not only gives longer life to the essential die parts but it also insures accurate production of piece parts for a longer period. An automatic stop is used for faster production.

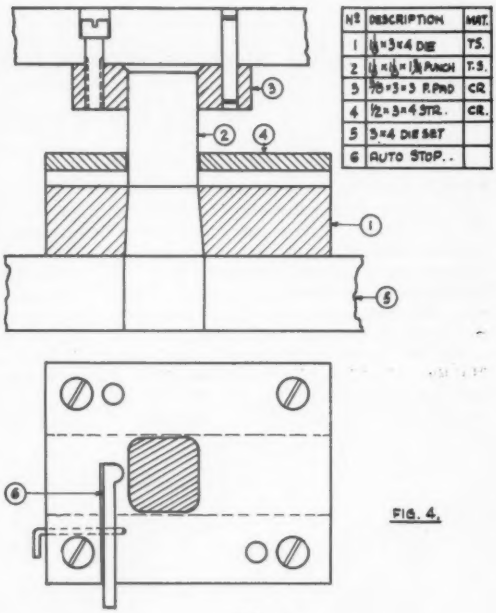


Fig. 4

With all the parts now in order, we are ready to analyze the time which must be allowed for machining these parts and the hand work required for fitting them. The die block is to be squared on all sides, ground on top and bottom, drilled and reamed for screws and dowels, after which it is ready for the layout of the die opening. With the outline of the blank laid out in its proper place on the die surface, we begin the removal of the material from the die opening. Various methods and machines have been developed for this particular work and especially in the last few years, the die maker has been provided with real time-saving equipment. Among them are metal cutting band saws, continuous die filing machines, combination sawing and filing machines, precision jib boring machines and special tools, all designed to improve die making methods and particularly to insure greater accuracy.

One of the other methods requires the locating and drilling of a number of holes around the inside contour of the die opening. These have to be drilled with great care on an accurate drilling machine. After such drilling, the core must be removed with a chisel or by some other means. It naturally leaves a ragged inside contour of half-circles which can be brought to the line only by filing; also care must be exercised to establish the required taper. With this method the time element cannot be of as great importance to the die maker because of the extreme care he must use to attain the accuracy which the die specifications demand, in this case the specified limit being ± .002".

A newer method is more simple because machines do most of the work. After carefully setting up the die block on the jig borer, one hole is drilled in each corner, the location of which can be held to as close a tolerance as .0001 without difficulty. Next the job is set up on a metal band saw and with a good operator the core can be sawed out quickly and accurately to the line leaving very little stock to be filed. This method speaks for itself from the standpoint of time-saving. There are other methods too numerous to detail therefore the values represented in the tables will have to be taken as average values and subject to each shop's machine equipment.

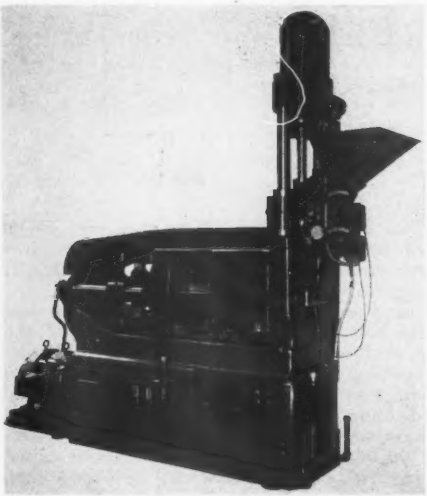
With the opening in the die block finished to the required tolerance, it may now be hardened, after which its top and bottom must be ground. It is then ready for mounting on the die shoe.

(Continued on page 28)

LPM Fully-Automatic Injection Molding Machines

THE plastics field is one of rapidly growing importance to the die shop. Even if present plans or setup do not include dies for molds, die men are becoming more and more interested in the development of plastic machines. Modern requirements have made necessary new pressure casting equipment.

The LPM Fully-Automatic Injection Molding Machines for the production of castings from thermo-plastics are the result of a background of over 20 years in designing and building pressure casting machines.



The operator's side of the LPM Fully-Automatic Injection Molding Machine showing the cast-beam construction, the sleeve type heating cylinder and the injection piston. The pair of automatic temperature controls, the hydraulic gages and the control panel are visible and controlled from one position. The operating handle for semi-automatic operation is at the center of the base.

A heavy cast-steel beam across both top and bottom of the machine replaces the conventional tie bars and insures rigid locking of the molds when the material is injected into the mold. This feature eliminates flash due to the actual stretching of structural members during the process of injection.

When the mold closes, the cam faces on the toggle pins engage and the entire force of injection is taken off of the toggle pins. The wear on the toggle pins is reduced to a minimum since they are only used to open and close the mold.

The patented adjustment of the movable die plate enables the operator to change molds easily and quickly, the worm and wheel adjustment opens or closes the die space to the required mold thickness. No further adjustment of the toggles is required, a perfect alignment of the faces of the mold is insured regardless of the skill or experience of the setup man. A positive driven knock-out mechanism is provided to remove the finished pieces from the machine.

A sleeve type heating cylinder is equipped with two automatic temperature controls which enables the operator to accurately regulate the temperature of the material from the time it enters the heating cylinder until it is injected into the mold. Such accurate automatic temperature control makes larger castings possible without any danger of burning the material. The injection

plunger is rigidly guided in a hardened and ground, water cooled, steel bushing. This sleeve type heating cylinder construction eliminates the loss of injection pressure incurred when it is necessary to spread the material after compression has started inside of the heating cylinder.

The entire heating cylinder can easily be swung away from the mold, providing a clear opening to the rear of the mold that enables the operator to quickly remove any sprues, which may have broken off in the mold, without the risk of damaging the sprue bushing. The feeding of material into the cylinder on each stroke of the injection piston is simply adjusted. Once the feed is established a self-compensating feeding device insures an even supply of material and eliminates short shots.

The complete cycle of the machine is controlled by three time clocks mounted in a panel box in the base on the operator's side of the machine.

The LPM injection molding machine can also operate semi-automatic when a single operating handle is employed.

A hydraulic pump located in the base of the machine, motor driven, provides hydraulic pressure for operation. All piping is stationary and is not affected by the movements of the machine thus eliminating one of the most frequent causes of hydraulic system oil leaks.

The molding machine is made in three models—4, 6 and 8 ounce molding capacity per shot and operate at rates of from 3 to 400 shots per hour.

A bulletin showing details of operation, giving full explanations and specifications of the new LPM Full Automatic Injection Molding Machine can be obtained by writing Index Machinery Corporation, 51 Central Avenue, Cincinnati, Ohio, and asking for Bulletin TD-6.

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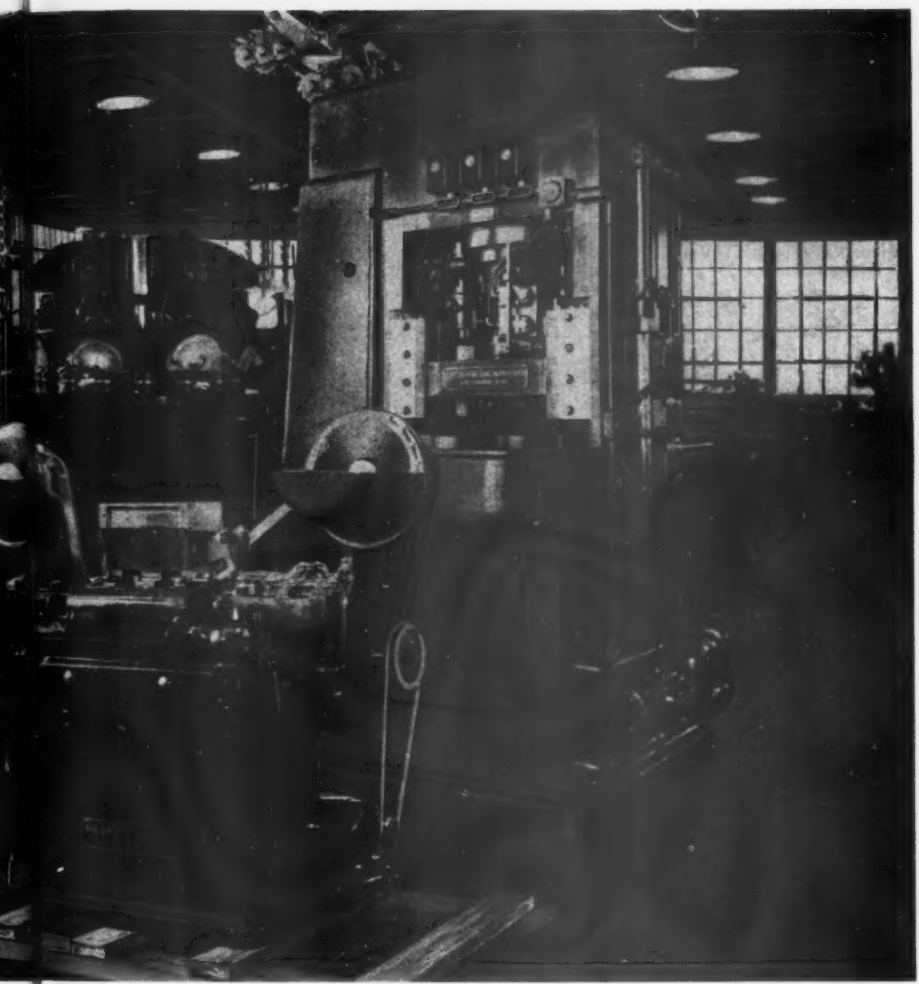

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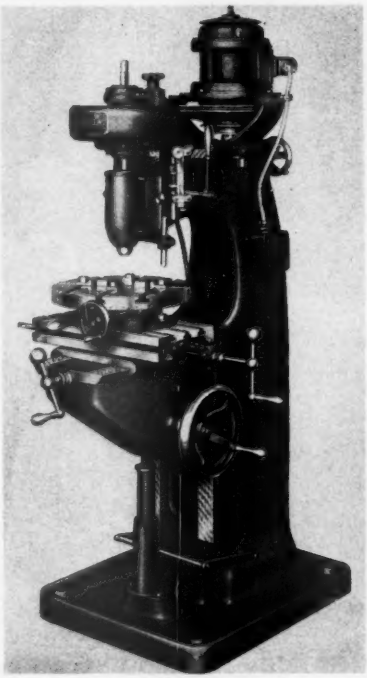
Reed-Prentice No. 2V Router and Miller

THE Reed-Prentice No. 2V Milling Machine is a versatile, high-speed production unit for representative die, engraving and general run of milling operations. The entire machine is ruggedly built, particularly the column and knee where the rigid full box design entirely eliminates vibration and its resultant effect on the work. All castings contain a high percentage of steel to suit the duty involved.



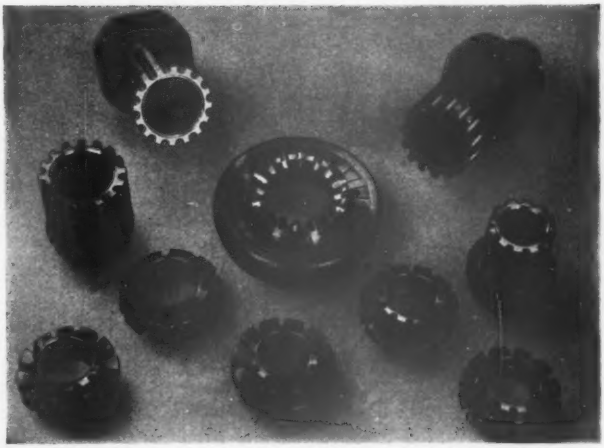
The spindle is chrome molybdenum S.A.E. 4140 steel ground all over and carried in ball bearing mounting. Selected Fafnir deep race design precision ball bearings are mounted in preloaded condition to take thrust and radial loads. A new design of sliding head fitted to dovetail of column, the generous bearings of dovetail slide are hand scraped to insure perfect alignment of spindle and long life. Either a 1 or 2 HP motor, constant or two-speed, vertically mounted, gives 10 or 20 spindle speeds respectively. Both spindle and motor pulleys are four step. Pulleys are of heat treated aluminum alloy, balanced for high speeds. Binder handles, a new feature, are now supplied in place of binder nuts for locking the motor bracket, sliding head saddle and knee, in position.

Spindle can be provided with collet sleeve to take old style collets if desired. Control of head is by foot treadle and clutch type handle.

Profile device is attached to sliding head and is easily removable and can be reversed with pin at left or right. Micrometer depth stop is attached to sliding head; dial is graduated to thousandths, with vertical scale graduated to two inches and sub-divided in tenths.

Saddle extends full length of table and forms rigid support for it. Saddle is accurately hand scraped and securely gibbed to knee, table scraped and gibbed to saddle. Where extreme accuracy is required verniers for cross and longitudinal feeds can be supplied. Attachments including new No. 2V collets of improved construction, with long and gradual taper, rotary table, blower, oil pump driven through separate motor with tank and piping, lamp brackets, verniers for cross and longitudinal feed, cutters, etc., are available.

For full details and specifications of the No. 2V Router and Vertical Milling Machine, write to Reed-Prentice Corp., 679 Cambridge St., Worcester, Mass., and ask for Circular No. P18-201-7.



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WALTON Tap Extractors save their cost in the course of a year in tool and die rooms and both special and production machine shops in time saved alone. In addition, no annealing, drilling or special tools are required to grip and back out broken tap pieces easily, quickly and without damage to threads. The Walton Tap Extractor is very simple in construction. Alloy steel "fingers" which slide along the holders are gently pushed into the flutes of the tap. Then the holder is pushed down until it touches the broken tap, after which the sleeve is pushed down until it touches the work. A tap wrench is then applied to the square end of the holder, twisted forward and backward a few times to loosen, and the tap is backed out.

Walton Tap Extractors to fit machine screw and pipe taps in 2, 3 and 4 flute styles are stock equipment. Sets of 4, 5 or 6 extractors are shipped in polished wood cases without extra cost. The Walton Tap Extractors with world wide distribution have demonstrated their ability to speed production, cut costs and facilitate maintenance.

A leaflet giving data on sizes, styles and prices of Walton Tap Extractors and details of Special Introductory offer is available from the manufacturer, the Walton Company, Hartford, Connecticut. Ask for Leaflet FP.

Endres Promoted by Billings & Spencer

THE Billings & Spencer Company of Hartford, Connecticut, manufacturers of Billings Forged Tools, has appointed W. D. Endres as Sales Manager in charge of their Merchandise Tool Division succeeding W. Roy Moore, recently resigned.

Mr. Endres, who is a native of Kansas City and a graduate of Northwestern University, has been Divisional Manager of the Billings & Spencer Chicago branch office and warehouse. "Dorse" Endres has done extensive merchandising and sales promotional work over the past several years and, in addition, has had considerable experience in sales direction.

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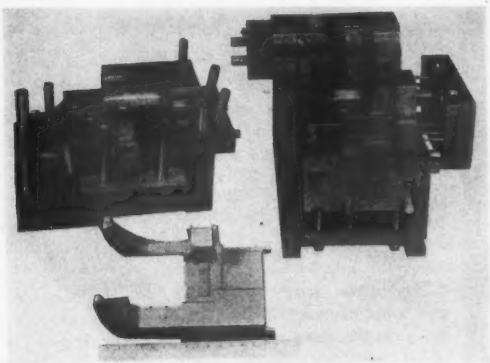

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Stanley Tool Introduces New Contour Grinder

A NEW high speed Contour Grinder No. 150 for tool and die makers for finishing dies, gauges, templets and special shapes has just been announced by Stanley Electric Tool Division. Equipped with a ⅜ H.P. universal motor operating at a speed of 18,000 R.P.M., the Contour Grinder has a work table with 12″ x 12″ top and an adjustable light fixture.

Motor is held directly under the work table in a holder that is adjustable from 90° to 45°. Mounted point, wheel or rotary file projects through opening in the table top.

Using various shaped mounted points, up to ¼″ shank, in the chuck or wheels on the arbor, a great many grinding operations can be done rapidly, eliminating time spent in stoning and filing.

Complete equipment includes motor, work table, light fixture, chuck, arbor, an assortment of mounted points and rotary files in a wooden block, and a six-foot extension cord.

A four-page circular on the Stanley Contour Grinder No. 150 is available from Stanley Electric Tool Division, New Britain, Conn. Ask for Circular TD-5.

A Correction

Last month we published a brief advance note on the 1939 Machine and Tool Progress Exhibition, which will be held in Convention Hall, Detroit, Michigan, March 14 to 18 inclusive. The heading which read "Machine Tool Exhibition" should have read "Machine *and* Tool Exhibition."

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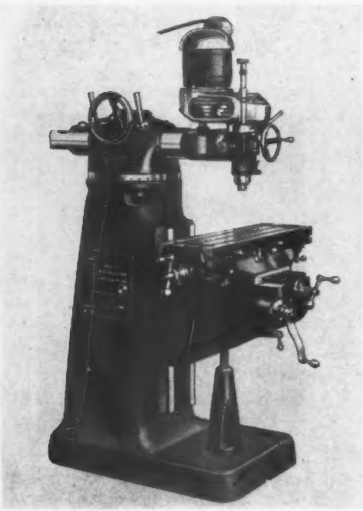
New Bridgeport Turret Miller

A NEW Turret Milling Machine, a versatile unit for tool room and both large and small machine shops, designed so that the milling spindle can be moved in and out as well as to each end of the table, giving it more range than any vertical machine twice its size, has been announced by Bridgeport Machines, Inc. The turret is 15 inches



in diameter with a 5-inch overarm which is amply rigid. Provision has been made for a "Slotting Attachment" on the opposite end of the overarm, making it possible to use the machine for two different operations.

The keyed overarm has worm wheel control which permits setting of the overarm at any angle. The table, knee and saddle locks are located in the front of the machine for convenient operation.

Angular settings in one plane are achieved by turning the handwheel which controls the keyed overarm. The ease and accuracy of making angular settings is one of the flexibility features of the Bridgeport Turret Milling Machine.

Rugged column, knee and table construction with wide ways and taper gibs make for accurate and vibrationless operation.

The turret milling machine has a longitudinal feed range of 20 inches, crossfeed of 9 inches and 16 inches vertical feed of knee. A range of six spindle speeds from 275 to 4250 R.P.M. is possible; drive is by a ½ HP heavy duty motor. Drilling and boring feed is rack and worm. No. 2 Morse or No. 7 B&S taper spindle is optional as standard equipment.

Anti-friction bearings are used throughout the machine. Large graduated dials are 3¼" in diameter. All Bridgeport attachments manufactured since 1930 will fit the Standard Adapter furnished with this machine.

An illustrated specification sheet, P-2, on the new Bridgeport Turret Milling Machine is available from the builder, the Bridgeport Machines, Inc., 54 Remer Street, Bridgeport, Conn.

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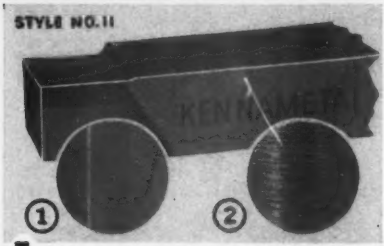

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Die Designing & Estimating

(Continued from Page 17)

The punch also has to be squared and ground on all sides—allowing of course for clearance in the die. When the radii have been machined the punch is ready to be fitted into the punch pad. The pad itself must undergo squaring and grinding operations on top and bottom and after drilling for screws and dowels, a hole similar to the die opening is cut in much the same manner as was the die opening and into this the punch is fitted. The punch plate and the punch are now ready to be mounted on the punch holder.

The stripper is machined and ground on at least one side—the side which makes contact with the die surface. A slot for guiding the strip of material must be cut, screw and dowel holes drilled (screw holes may have to be counterbored), a clearance hole similar to the die opening will have to be machined and after locating and mounting the automatic stop, the stripper is ready to be mounted on the die block. Now there remain only the mounting of the stripper and die block on the die shoe and the punch plate and punch holder. To accomplish this, holes again will have to be transferred and drilled, some tapped and some counterbored. A clearance hole for the blank will have to be machined into the die shoe and with the assembling of the parts, the die should be finished and ready for production. It is generally necessary, however, to take it apart one or more times because of mis-alignment or for other minor adjustments before it is so perfectly assembled that it produces accurate parts.

Let us assume that the die is now ready and working satisfactorily. Looking back for a moment we may think we did quite a job but we forgot one thing—we did not keep track of the time we put into the building of the die. Perhaps the operations as described are not in accordance with the procedure in some shops and a few items may even have been omitted altogether. However, the purpose of going through the procedure was to emphasize the necessity for the estimator to list the operations as they may be carried on in making a die of this type in his shop.

When an experienced estimator vis-

(Continued on Page 38)

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BUSHINGS—Drill Jig
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Colonial Bushings, Inc., 147 Jos. Campau Ave., Detroit, Mich.

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CHROME PLATING—Dies and Machine Parts, New and Worn
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Danly Machine Specialties, Inc., 2121 So. 52nd Ave., Chicago, Ill.

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CUTTERS—Die-sinking
Eclipse Counterbore Co., 7428 St. Aubin Ave., Detroit, Mich.

● This directory of products lists for ready reference the names of manufacturers and dealers whose sales to Tool·Die·Machine PROGRESS readers have established them as dependable in every sense of the word. They merit your consideration.

● Complete information about any product may be had upon request made to the firm listed or to us.

● Your mention of Tool·Die·Machine PROGRESS will be appreciated.

CUTTERS—Milling
Putnam Tool Co., 2985 Charlevoix Detroit, Mich.

CUTTERS—Multi Diameter
Eclipse Counterbore Co., 7428 St. Aubin Ave., Detroit, Mich.

CUTTING MACHINES—Hand & Power
Buffalo Forge Co., 477 Broadway, Buffalo, N Y.

DE-MAGNETIZER
Arlavox Mfg. Co., 428 So. Green St., Chicago, Ill.

DIAMOND STONES
Carborundum Co., Niagara Falls, N. Y.

DIAMOND WHEELS
Carborundum Co., Niagara Falls, N. Y.

DIE CASTING MACHINES
Phoenix Ice Machine Co., The, 2711 Church Ave., Cleveland, Ohio.
Reed-Prentice Corp., Worcester, Mass.

DIE MAKERS SUPPLIES
Acme Industrial Co., 206 No. Laflin St., Chicago, Ill.
Danly Machine Specialties, Inc., 2121 So. 52nd Ave., Chicago, Ill.
F. C. Danneman Co., 203-205 Lafayette St., New York, N. Y.
Die Supply Co., 2059 Hamilton Ave., Cleveland, Ohio.

DIE MAKING MACHINES
Continental Machine Specialties, Inc., 1301 Wash. Ave., Minneapolis, Minn.
Grob Brothers, Grafton, Wis.

DIE SECTIONS—Composite Steel
Die Supply Co., 2059 Hamilton Ave., Cleveland, Ohio.
Forging and Casting Corp., Ferndale (Detroit), Michigan.

DIE SECTIONS—Forged
Ajax Steel and Forge Co., 205 Adair St., Detroit, Mich.

DIE SETS
Danly Machine Specialties, Inc., 2121 So. 52nd Ave., Chicago, Ill
F. C. Danneman Co., 203-205 Lafayette St., New York, N. Y.
Die Supply Co., 2059 Hamilton Ave., Cleveland, Ohio.

DIE SINKING MACHINES
Reed-Prentice Corp., Worcester, Mass.

DOWEL PINS
Acme Industrial Co., 206 No. Laflin St., Chicago, Ill.
Danly Machine Specialties, Inc., 2121 So. 52nd Ave., Chicago. Ill
Die Supply Co., 2059 Hamilton Ave., Cleveland, Ohio.

DRESSING STICKS
Carborundum Co., Niagara Falls, N. Y.

DRILLING MACHINES—Automatic
Sommer & Adams Co., The, 18511 Euclid Ave., Cleveland, Ohio.

DRILL JIG—Toggle Action
Knu-Vise Products Co., Inc., 6433 Cass Ave., Detroit, Michigan.

DRILL JIG—Universal
Hartford Special Machinery Co., Hartford, Conn.

DRILL JIG BUSHINGS
Acme Industrial Co., 206 No. Laflin St., Chicago, Ill.
Colonial Bushings, Inc., 145 Jos Campau St., Detroit, Mich.

DRILL PRESSES—Single & Multiple Spindle
Buffalo Forge Co., 477 Broadway, Buffalo, N. Y.

ELEVATING TABLES—Portable
Hamilton Tool Co., The, 223 North B Street, Hamilton, Ohio.

END MILLS
Progressive Tool & Cutter Co., Ferndale, Michigan.
Putnam Tool Co., 2985 Charlevoix, Detroit, Mich.

EXTRACTOR—Broken Tap
The Walton Co., 88 Allyn St., Hartford, Conn.

FILES—Hand
Grobet File Corp. of America, 3 Park Place, New York, N. Y.

FILES—Rotary
Grobet File Corp. of America, 3 Park Place, New York, N. Y.
Hamilton Tool Co., The, 222 North B Street, Hamilton, Ohio.

FILING MACHINES—Continuous
Continental Machine Specialties, Inc., 1301 Washington Ave., S., Minneapolis, Minn.
Grob Brothers, Grafton, Wis.

FORGINGS—General
Ajax Steel & Forge Co., 205 Adair St., Detroit, Mich.

FORGINGS—Water and Oil Hardening, High Speed, Special Alloy, Stainless and S.A.E. Steel
Forging and Casting Corp., Ferndale (Detroit), Michigan.

GAGES—Spring Stop
Knu-Vise Products Co., Inc., 6433 Cass Ave., Detroit, Michigan.

GAGE BLOCKS
Ford Motor Co., Johansson Div., Dearborn, Mich.

GEARS—Special—14 to 96 D.P.—Made to Order Only
Gear Specialties, Inc., 2840 Medill Ave., Chicago. Ill.

GRINDER—Precision for Contours
Baker Brothers, Inc., Toledo, Ohio.
Boyar-Schultz Corp., 2114 Walnut Street, Chicago, Ill.
Koestlin Tool & Die Corp., 3601 Humboldt Ave., Detroit Mich.

GRINDING & LAPPING — Precision
Acme Industrial Co., 206 No. Laflin St., Chicago, Ill.

GRINDING WHEELS
Carborundum Company, The, Niagara Falls, New York.

GUIDE PINS
Acme Industrial Co., 206 No. Laflin St., Chicago, Ill.
Danly Machine Specialties, Inc., 2121 So. 52nd Ave., Chicago, Ill.

HONING STICKS
Carborundum Co., Niagara Falls, N. Y.

JIG BORING—Contract
Kiffer Tool & Die Co., 5601 Tillman Ave., Cleveland, Ohio.
Swiss Boring Co., 3916 Vermont Ave., Detroit, Mich.

JIG BORING TOOLS
Eclipse Counterbore Co., 7428 St. Aubin Ave., Detroit, Michigan.

LAPS—Copper Head Expansion
Beyer-Schultz, Inc., 2114 Walnut Street, Chicago, Ill.

LAPPING COMPOUND
Carborundum Co., Niagara Falls, N. Y.

LAPPING MACHINES
Schraner & Co., A. P., 2338 Payne Ave., Cleveland, Ohio.

LEADER PINS
Acme Industrial Co., 206 No. Laflin St., Chicago, Ill.
Die Supply Co., 2059 Hamilton Ave., Cleveland, Ohio.

MACHINE BASES—Fabricated
Die Supply Co., 2059 Hamilton Ave., Cleveland, Ohio.

MACHINE REBUILDING
Enterprise Machine Parts Corp., 2731 Jerome Avenue, Detroit, Mich.

MAGNETIC SINE TABLE
Omer E. Robbins Co., 637 Mt. Elliott Ave., Detroit, Mich.

MILLING MACHINES—Vertical
Reed-Prentice Corp., Worcester, Mass.

MILLING MACHINES—Continuous
Sommer & Adams Co., The, 18511 Euclid Ave., Cleveland, Ohio.

MOLDING MACHINES—Plastic
Reed-Prentice Corp., Worcester, Mass.

NUMBERING DEVICES
H. O. Bates, 251-257 North Broad St., Elizabeth, N. J.

PARALLELS
Ford Motor Co., Johansson Div., Dearborn, Mich.

POLISHING & BUFFING MACHINES—Automatic Continuous
Sommer & Adams Co., The, 18511 Euclid Ave., Cleveland Ohio.

POLISHING GRAIN—
Carborundum Co., Niagara Falls, N. Y.

PUNCHES—Hand, Toggle Action
Knu-Vise Products Co., Inc., 6433 Cass Ave., Detroit, Michigan.

PUNCHES—Standard & Interchangeable
Hovis Screwlock Co., 3129 Larned St., E., Detroit, Mich.

REAMERS
Putnam Tool Co., 2985 Charlevoix Ave., Detroit, Mich.

REAMER—Self-centering Cylinder
Royal Oak Tool & Machine Co., 621 E., Fourth Street, Detroit, Mich.

REPAIR PARTS FOR MACHINERY
Enterprise Machine Parts Corp., 2731 Jerome Ave., Detroit, Mich.

RETAINERS—Punch & Die
Hovis Screwlock Co., 3129 Larned St., E., Detroit, Mich.

RIVETING MACHINES
Buffalo Forge Co., 477 Broadway, Buffalo, N. Y.

ROLLER DIE FORMING MACHINES
McKinney Tool & Mfg. Co., The, 1688 Arabella Rd., Cleveland, Ohio.

SALVAGE—Tool-Die & Machine Parts
Master Chrome Service, Inc., 5911 Herman Ave., N.W., Cleveland, Ohio.

SAND BLASTING
Porter Steel Treating Co., The Geo. H., 1235 Marquette Bl., Cleveland, Ohio.

SAW & SHEAR CUT-OFF MACH.—Automatic
McKinney Tool & Mfg. Co., The, 1688 Arabella Rd., Cleveland, Ohio.

SAWING MACHINES—Continuous
Continental Machine Specialties, Inc., 1301 So. Washington St., Minneapolis, Minn.

SAWING MACHINES—Open End
Grob Brothers, Grafton, Wis.

SCREW MACHINE PRODUCTS—Contract
Star Machine & Tool Co., 9830 Woodland Ave., Cleveland, Ohio.
Ulmer Co., The J. C., 1791 East 38th St., Cleveland, Ohio.

SCREW MACHINE PRODUCTS—Hardened & Ground
Acme Industrial Co., 206 No. Laflin St., Chicago, Illinois.

SCREWS—Socket Head
Danly Machine Specialties, Inc., 2121 So. 52nd Ave., Chicago, Ill.
Die Supply Co., 2059 Hamilton Ave., Cleveland, Ohio.
Holo-Krome Screw Corp., The, Hartford, Conn.
Strong, Carlisle & Hammond Co., 1392 West Third St., Cleveland, Ohio.

SCREWS—Transfer
Nielsen Tool & Die Company, 1259 Gardner Ave., Berkley, Michigan.

SCRIBERS
Ford Motor Co., Johansson Div., Dearborn, Mich.

SHARPENING STONES
Carborundum Co., Niagara Falls, N. Y.

SHEARS—Bolt & Rivet—Automatic
Buffalo Forge Co., 477 Broadway, Buffalo, N. Y.

SINE BARS
Ford Motor Co., Johansson Div., Dearborn, Mich.

SPACERS—For Milling Machine Arbors
Detroit Stamping Co., 3443 West Fort St., Detroit, Mich.

SPACING FIXTURES
Hartford Special Machinery Co., Hartford, Conn.

SPRING MAKING MACHINERY
Sleeper & Hartley, Inc., Worcester, Massachusetts.

SPRINGS—Die
Danly Machine Specialties, Inc., 2121 So. 52nd Ave., Chicago, Ill.
Die Supply Co., 2059 Hamilton Ave., Cleveland, Ohio.

STAMPINGS
Barth Stamping & Mach. Works, W. 94th & Denison, Cleveland, Ohio.
Davis Tool & Engineering Co., 6481 Epworth Blvd., Detroit, Mich.
Denning Mfg. Co., The, 1775-81 E. 57th St., Cleveland, Ohio.
Detroit Stamping Co., 3443 West Fort St., Detroit, Mich.
Modern Tool & Die Co., P. O. Box 3741, Cleveland, Ohio.
Rockford Die & Tool Wks., Inc., 1816 Seventeenth St., Rockford, Ill.
Star Machine & Tool Co., 9830 Woodland Ave., Cleveland, Ohio.
Star Tool & Die Works, 2522 24th St., Detroit, Mich.
Ulmer Co., The J. C., 1791 East 38th
Variety Machine & Stamping Co., The, 12805 Elmwood Ave., Cleveland, Ohio.
St Cleveland, Ohio.

STAMPS—Steel
H. O. Bates, 251-257 North Broad St., Elizabeth, N. J.

STEEL—Alloy
Columbia Tool Steel Co., 410 East 14th St., Chicago Heights, Ill.
Darwin & Milner, Inc., 1258-64 West Fourth Street Cleveland, Ohio
William Jessop & Sons, Inc., 121 Varick St., New York, N. Y.
Wheelock-Lovejoy & Co., Inc., 130 Sidney St., Cambridge, Mass.

STEEL—Carbon
Columbia Tool Steel Co., 410 East 14th St., Chicago Heights, Ill.
Darwin & Milner, Inc., 1258-64 West Fourth Street Cleveland, Ohio
William Jessop & Sons, Inc., 121 Varick St., New York, N. Y.

STEEL—Chromium
Darwin & Milner, Inc., 1258-64 West Fourth St., Cleveland Ohio.

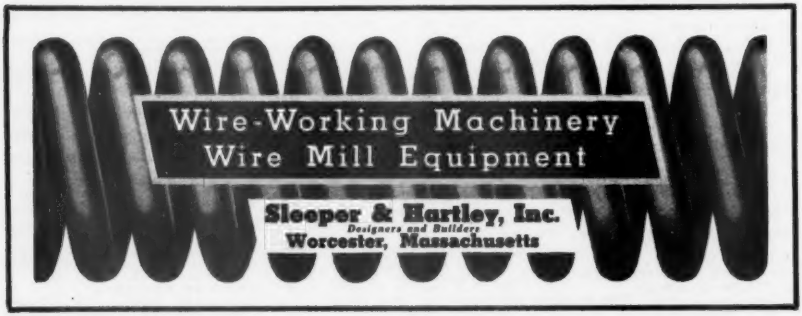
STEEL—"Cobalt"
Darwin & Milner, Inc., 1258-64 West 4th St., Cleveland, Ohio.

STEEL—High Speed
Ajax Steel & Forge Co., 205 Adair St., Detroit, Mich.
Columbia Tool Steel Co., 410 East 14th Street, Chicago Heights, Ill.
Darwin & Milner, Inc., 1258-64 West 4th St., Cleveland, Ohio.
William Jessop & Sons, Inc., 121 Varick St., New York, N. Y.

STEEL—Stainless
Ajax Steel & Forge Co., 205 Adair St., Detroit, Mich.

STEEL—Tool & Die
Columbia Tool Steel Co., 410 E. 14th St., Chicago Heights, Ill.
Darwin & Milner, Inc., 1258-64 West 4th St., Cleveland, Ohio.
William Jessop & Sons, Inc., 121 Varick St., New York, N. Y.
Wheelock-Lovejoy & Co., Inc., 130 Sidney St., Cambridge, Mass.

STEEL PLATE—Ground
Die Supply Co., 2059 Hamilton Ave., Cleveland, Ohio.



STEEL PLATE—Rough or Machined Torch Cut Shapes
Danly Machine Specialties, Inc., 2121 So. 52nd Ave., Chicago, Ill.
Die Supply Co., 2059 Hamilton Ave., Cleveland, Ohio.

STEEL TREATING—Hardening
Perier Steel Treating Co., The Geo. H., 1235 Marquette St., Cleveland, Ohio.

STRAIGHT EDGES
Ford Motor Co., Johansson Div., Dearborn, Mass.

STRAIGHTENING MACHINES
Buffalo Forge Co., 477 Broadway, Buffalo, N. Y.

TAP EXTRACTOR
The Walton Co., 88 Allyn St., Hartford, Conn.

TAPPER—Precision
The Master Tapper Co., 2 Main St., Belleville, N. J.

TAPPING MACHINES
Buffalo Forge Co., 477 Broadway, Buffalo, N. Y.

TAPPING MACHINES—Tool Room
The Master Tapper Co., 2 Main St., Belleville, N. J.

TOOLS AND DIES—Carboloy
Kiffer Tool & Die Co., 5601 Tillman Ave., Cleveland, Ohio.

TOOLS—Cemented Carbide Tipped
Eclipse Counterbore Co., 7428 St. Aubin Ave., Detroit, Mich.

TOOL CHESTS
Gerstner Tool Chests, 56 Columbia St., Dayton, Ohio.

TOOL HEAD—Universal
Precision Tool Co., The, Bridgeport, Conn.

TRANSFER SCREWS
Nielsen Tool & Die Co., 1359 Gardner Avenue, Berkley, Michigan.

TRANSMISSION UNITS
Ohio Ball Bearing Co., 6581 Euclid Avenue, Cleveland Ohio.

TUBING—Tool Steel
Bissett Steel Co., The, 947 E. 67th St., Cleveland, Ohio.

TYPE HOLDER
H. O. Bates, 251-257 North Broad St., Elizabeth, N. J.

VENTILATING APPARATUS
Buffalo Forge Co., 477 Broadway, Buffalo, N. Y.

WASHERS—Special
Detroit Stamping Co., 3443 West Fort St., Detroit, Mich.

WELDING
Danly Machine Specialties, Inc., 2121 So. 52nd Ave., Chicago, Ill.
Overly-Hautz Co., 1621 West 116th St., Cleveland, Ohio.
Star Tool & Die Works, 2532 24th St., Detroit, Mich.

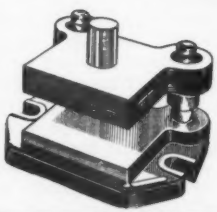
WELDING PLIERS
Knu-Vise Products Co., Inc., 6433 Cass Ave., Detroit, Michigan.

WIRE MILL EQUIPMENT
Sleeper & Hartley, Inc., Worcester, Massachusetts.

WIRE-WORKING MACHINERY
Sleeper & Hartley, Inc., Worcester, Massachusetts.

DANNEMAN *Precision* DIE-SETS

WRITE FOR CATALOG—FP



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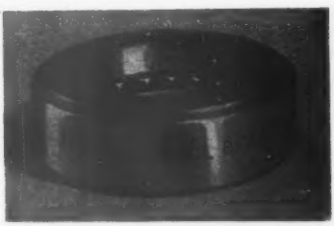
All leading ball and roller thrust bearings, banded as shown or without band and using steel or bronze retainers. Also all types of ball and roller bearings and transmission equipment.



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Write for circular and prices

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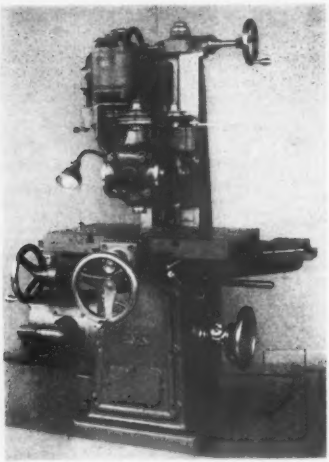

Hack Introduces New Multi-Versal

"Twenty-six different kinds of cutting operations can be done with the Multi-Versal Machine . . . practical application of both reciprocating and rotary cutting."

THE Hack Multi-versal Machine, improved and with new features that include a built-in duplicating unit for plastic molds and work of similar nature, is especially adaptable to precision machine work and tool and die making. The duplicating feature differs from other duplicating machines or devices in that both cylindrical and vertical cutting can be done and cutters up to 4 or even 6 inches in diameter can be used in roughing cuts when advisable. Twenty-six different kinds of cutting operations can be done with the Multi-versal Machine.

The Multi-versal has been designed to perform as a multi-purpose machine tool and the machine can be used for both reciprocating and rotary cutting. Built-in features include a reciprocating rear ram and the master head represents a distinct departure from conventional machine features, reducing the number of attachments needed to a minimum, but materially increasing the applications of the machine.

The Master Head is a self-contained horizontal milling unit, receiving its power through a vee belt from a motor adjustably attached to the master head. Six back geared speeds suitable for driving cutters, ranging in size from a 1-inch end mill to an 8-inch face mill are provided. The master head serves as a carrier for all removable attachments and is fitted with a central boss about the spindle which serves to centrally locate the attachments.

The vertical head receives its back geared cutting power from the master head by means of a sleeve inserted within the master spindle. When the draw bar is removed from the spindle, the head is free to rotate at high speed and is driven directly from the motor by a vee belt. The head can be revolved 360 degrees around the master spindle. An auxiliary vertical head, furnished as extra equipment, can be fitted to the side opening and will permit rotation through 360 degrees at right angles to the vertical head. Either of these heads will pull a cutter 3 inches in diameter through cast iron with a cut ¼" deep.

The photograph shows the vertical head in place and belt drive to master head which has 4 back geared speeds. The same speeds are transmitted to the vertical spindle. Open belt speeds are obtainable by driving through from the motor to the vertical cone pulley. Set-up time 2½ minutes.

Heavy duty files, heavy duty slotting tools and the combination high speed die filer and slotter can be attached to the master head or driven from the vertical head. When attached to the side opening in the vertical head it is driven through bevel gears in four speeds suitable for small and medium die filing.

The Hack Machine Co., 444 North Oakley Blvd., Chicago, Ill., has prepared a 24-page (well illustrated) booklet, available on request. Ask for Catalog TD-2.

When you order or write about products described in TDM PROGRESS please mention the publication.

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1. Switch to Mac-its for accurate fit, longer life.
2. Wherever ordinary screws break, strip or mushroom, use Mac-its to cut costs in the long run.
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Get details and prices from your Mac-it distributor, or write for Catalog 38.

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The Hartford SUPER-SPACER: Modern device for fast, errorless indexing in milling, drilling, grinding, slotting, planing, Substantially built for modern machine tool speeds and feeds. Efficient for small lots or large production.

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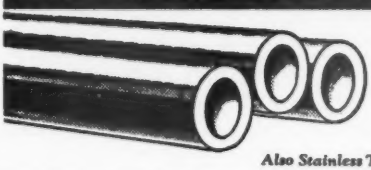
Write or phone for our copyrighted Hardness Conversion Chart

OIL HARDENING TOOL STEEL TUBING



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A SHOP KINK DEPARTMENT

In the next, March, issue T·D·M PROGRESS will begin a department on shop hints, kinks or "pet" short cuts. An inquiry we directed to a few carefully selected key shopmen brought an enthusiastic endorsement for such a section in this publication.

We invite our readers to send brief descriptions of a favorite time-saver including drawings or sketches for this department.

When you order or write about products described in TDM PROGRESS please mention the publication.

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Among these shops will be found modern facilities for building every kind of Special Tool, Die and Machine. Some are equipped for small and medium size work, others for large. Some do Designing and Engineering, Development and Experimental Work and build Models; others are equipped for production of Precision Specialties of every description. Still others operate Machine Production plants and manufacture Parts, Stampings and Complete Assemblies. All will appreciate the opportunity to submit estimates.

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*See larger display advertisement also.

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SWISS JIG BORING
DIE CASTING DIES

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Hamilton, Ohio

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220-222 North B Street
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Tools, Dies, Jigs, Fixtures, Special Machinery
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HAVE YOUR DIES WELDED
BY THE ATOMIC · HYDROGEN PROCESS

- Welding of Jigs and Fixtures
- Repairing and Refacing of Dies and Moulds
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ALL DIE WELDING DONE WITH STEEL OF SAME ANALYSIS AS YOUR DIE

THE OVERLY-HAUTZ CO.
1617 West 116th St. LAkewood 3640
Cleveland, Ohio

Die Casting Progress

(Continued from page 14)

to recommend to his customer.

The change as proposed by the die casting engineer and accepted by his customer, as shown in Figure No. 2, simplified the die, added strength where it was needed, saved metal where it was possible, gave an attractive finished design and saved the customer money. Such suggestions and changes could be illustrated again and again in die casting practice where the producer and the die casting engineer are working closely together in improving the design of finished products and in reducing die building and production costs.

Die cost would be greatly reduced if the product designer will bear in mind that decimal dimensions and close tolerances should be avoided where unnecessary. Some engineers think only in terms of plus or minus .001 when fractional dimensions would suit the purpose just as well.

The casting of thin sections has been an important development in the last few years. The development of dies for the automotive industry has had an important influence on the increased use of thin wall castings. Thin sections have become practical by the use of high pressures made possible by hydraulic operation. High pressures enable castings to be obtained with very fine finish.

The recent trends in die casting dies have required much study as to more efficient design, exact metal flow and thermal conditions, as well as carefully built dies having uniform wall thicknesses between the cores or inserts in the ejector die half and the cover half which usually carries the impression.

Modern tool room equipment is very essential to the die maker. The machine tool builders must be given due credit for the steady improvement in equipment that has been so important in the progress of die casting.

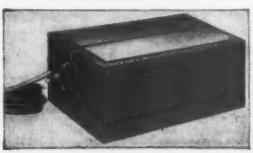
NIELSEN TRANSFER SCREWS
Locate drill holes perfectly and quickly

Simply insert in holes, invert, strike sharply and you have centers and drill circles perfectly located. Reduce time of other methods and eliminate spoilage.

7 Sizes · Inexpensive · Last for years · *Write for circular*

NIELSEN TOOL & DIE COMPANY
1859 Gardner Avenue Berkley, Michigan

ARLAVOX *heavy duty*
De-Magnetizer



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CARING FOR TOOLS *Pays!*

Systematic Care of tools pays the employer in increased production. The men will do more work and do it more easily when they care for their tools in a *Gerstner* Chest. The choice of particular men for 30 years. *Free Catalog.*

GERSTNER TOOL CHESTS
56 Columbia St., Dayton, Ohio

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A. S. T. E. Convention to Feature Symposiums, Exhibits

TWO symposiums, one on "Surface Finishing", the other on "New Developments and their effect on the Tool Engineer", will be features of the technical sessions of the A.S.T.E. Convention to be held in Convention Hall, Detroit, Michigan, March 14 to 18. The first session, to be held Tuesday evening, the 14th, will be under the chairmanship of Carl J. Oxford, chief engineer, National Twist Drill. J. R. Weaver, director of Equipment, Purchases, Inspection and Tests, Westinghouse Electric and Mfg. Co. will lead the discussion, followed by papers by representatives of Ex-Cell-O Corporation, Micromatic Hone Company, Heald Machine Company, Chrysler Corporation and others. Papers will cover such subjects as grinding, lapping, diamond boring, honing, and "super-finishing". The second session, to be held on Thursday evening will be under the chairmanship of Chris H. Bornemand, supervisor, Tool and Gage Service Department, General Electric Company. General opening of the convention will be Tuesday morning, with registration in Convention Hall. The rest of the day is set aside for visiting plants and the exhibits of close to 200 exhibitors.

The convention will close on Saturday and double the more than 27,000 visitors of last year are expected.

Bridgeport P&M Works Changes Name

THE Bridgeport Pattern and Model Works of Bridgeport, Connecticut, announces that they have disposed of their "Pattern Division," the original activity of the business, and that the company name has been changed to Bridgeport Machines, Inc. Rudolph F. Bannow, in making the announcement, states that the management remains unchanged and that the entire facilities of the company will be devoted to meeting the increased demand for "Turret Milling Machines," high speed milling attachments and precision spindles.

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You can rely on Progressive for End Mill Satisfaction. Our prices will interest you. Our prices are right.

A type for every job.

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Select the sizes of

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needed in your shop.

Use them for 30 days.

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Successor to Lyons Machine Co.

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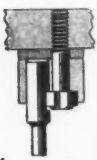

New Button Dies

Body diameters of the New Hovis Standardized Button Dies — and die hole sizes in Retainers are made approximately .002" larger in diameter than standard. ONE stock of Hovis button dies can thus be used for both the interchangeable type in standard retainers *and* the press fit type in standard reamed holes in 1" thick plates.

The Hovis method of retaining a punch makes it possible to make a group plate with all the characteristics of a hardened retainer without any of the limitations. The sizes of such plates are limited only by the jig boring capacity.

Special shaped and Alloy Steel Punches made to your requirements.

Write for Complete New Catalog.

HOVIS SCREWLOCK CO.

3129 E. Larned St. Detroit, Mich.

Die Designing & Estimating

(Continued from Page 28)

ualizes a die in its individual parts rather than as a whole, he automatically records the many operations which are required for building the die. On the other hand, when looking at the die as a whole, he is very liable to under-rate its value and thus under-estimate the labor which enters into its making. As we pointed out in our first article, "guess-timating" is a dangerous procedure and when it becomes an under-estimate of cost it invariably puts the die builder in a tight spot.

To sum up, here are the operations which enter into the building of the average cutting die:

a. Squaring blocks
b. Grinding before hardening
c. Screw and dowel holes
d. Other holes
e. Die layout (making template)
f. Machining die opening
g. Finishing die opening
h. Machining and fitting punch to die
i. Punch pad
j. Stripper
k. Clearance holes in die shoe
l. Stripper slot
m. Perforators
n. Perforator holes in die
o. Perforator holes in punch pad and stripper
p. Grinding after hardening
q. Assembling die and stripper to die shoe
r. Assembling punch and perforators to punch pad
s. Assembling punch pad to punch holder
t. Stops
u. Tryout
v. Inspection
w. Miscellaneous

Next month we will show how all of these can be brought together into six letters of the alphabet viz., a, b, c, d, e and f; to be followed by the principal tables and explanations.

PUBLICATION NOTICE

The first series on "Die Designing and Estimating" by Charles Bohmer will be published March 1st at $1.50 per copy, postpaid. Special pre-publication orders on first printing only at $1.00 per copy.

When you order or write about products described in TDM PROGRESS please mention the publication.

SEE IT AT THE A. S. T. E. SHOW

Detroit, March 14 - 18, 1939

Boyar-Schultz HEAVY-DUTY PROFILE GRINDER No. 2

A New Heavier Profile Grinder, built to handle Tool and Die work of the larger and more difficult types.

It is designed to do quickly, the exacting work on profiles, contours, uneven surfaces and odd shapes that under ordinary methods consume many costly hours. Not only does this New Profile Grinder work faster, but it does a better job, providing a cleaner ground surface.

The Boyar-Schultz Heavy Duty Profile Grinder No. 2 is a PRECISION MACHINE TOOL in every sense; smooth running and vibrationless. It is quickly and easily adjustable, all controls being located to operate conveniently from the front. Working parts are protected. Powered by a 2 H. P. G. E. Ball Bearing motor, spindle turns at approximately 10,000 R. P. M. with vertical oscillations of 100 per minute. It is a rapid stock remover even with small diameter wheels.

Write for Bulletin CL-2

Boyar-Schultz Portable PROFILE GRINDER No. 1

Is solving contour grinding problems for many Tool and Die Makers and Special Machine Shops.

Boyar-Schultz Profile Grinders are becoming NECESSARY tools in Tool and Die Shops, and in other shops whose work requires grinding, lapping and fitting to close limits. Light in weight Boyar-Schultz Portable Profile Grinder is easily removed from job to job. Operating at 20,000 R. P. M. it is ideal for grinding and fitting irregular shapes, difficult contours of dies, punches, templates and cams.

BOYAR-SCHULTZ CORPORATION

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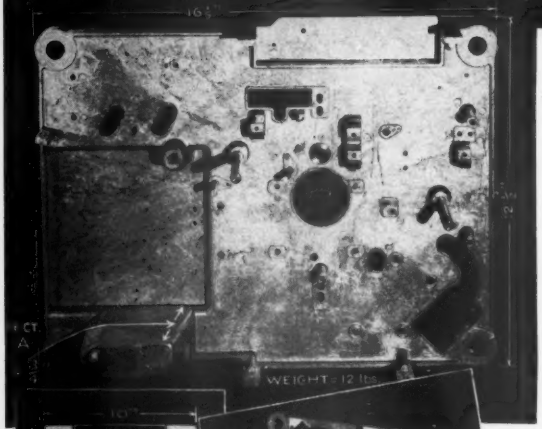

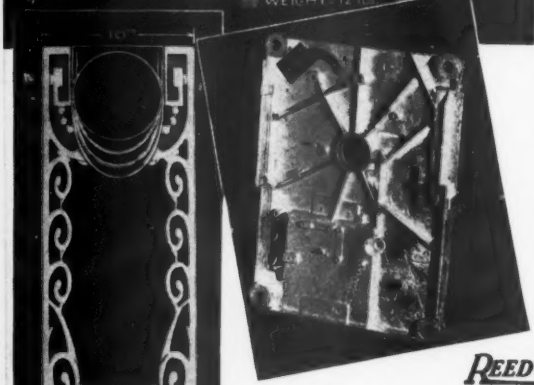

REED-PRENTICE

DIE CASTING MACHINE USED TO SUCCESSFULLY PRODUCE THESE INTRICATE PARTS..

TOP left: Zinc Alloy Die Cast Main Frame for a Wurlitzer Automatic Phonograph (insert shows reverse side). Size is 16½" wide by 12½" by 4¾" at section "A", weight 12 lbs., and tolerances are held as close as 0.002"—this on a long production run. Another example of modern die-casting practice is the Wurlitzer Phonograph Grille, also illustrated, size 25½" x 10½", weight 7½ lbs. It is significant that both these outstanding jobs are produced at the Cleveland Hardware & Forging Company on the REED-PRENTICE No. 2 Full Hydraulic Zinc Die Casting Machine shown. The semi-automatic mechanisms, the safety units, and many other modern REED-PRENTICE improvements are but a few of the features responsible for such outstanding examples of die-casting practice. This and other REED-PRENTICE Die Casting Machines to fill your needs are listed in detail in newly issued bulletins. Send for your copies today.

Photos and data courtesy The New Jersey Zinc Co., and Cleveland Hardware & Forging Co.

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New York Office: 75 West Street

REED-PRENTICE NO. 2 FULL HYDRAULIC ZINC DIE CASTING MACHINE

Size of die plates	32"x37"
Cap. of melting pot	900 lbs.
Space between bars	18"x21"
Die opens	12"
Die space	8" to 24"
Locking pressure	110 tons
Dia. Tie bars	3½"
Weight	16,500 lbs.

OTHER SIZES	NO. 1¼ ZINC	NO. 1¼ G ALUMINUM AND BRASS	NO. 3 G ALUMINUM AND BRASS	NO. 8 G BRASS
Size of die plates	28"x29"	28"x29"	32"x37"	34"x36"
Cap. of melting pot	700 lbs.	—	—	—
Space between bars	15"x18"	15"x18"	18"x21"	20"x22"
Die opens	10"	10"	12"	12"
Die space	6" to 18"	6" to 18"	8" to 24"	7½" to 17"
Locking pressure	90 tons	90 tons	110 tons	500 tons
Dia. Tie bars	3"	3"	3½"	6"
Weight	14,300 lbs.	11,250 lbs.	14,100 lbs.	49,900 lbs.